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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/655,866	09/05/2003	Jason Jyh-Shyang Jenq	46602-11421	7298

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EXAMINER	
NGUYEN, TUAN H	
ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 06/03/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/655,866

Applicant(s)

JENQ, JASON JYH-SHYANG

Examiner

Tuan H. Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 05 September 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-39 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 16, 17 and 19-39 is/are allowed.
- 6) ☒ Claim(s) 1-12 and 15 is/are rejected.
- 7) ☒ Claim(s) 13, 14 and 18 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 05 September 2003 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Specification

Claim Objections

Claim 2 is objected to because of the following informalities: In claim 2, line 1, "steps" should be changed to -- step-- to reflect a single step of forming a first barrier layer in claim 1. Appropriate correction is required.

Claim 14 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. "said second nitrogen-containing rapid thermal process" lacks antecedent basis, should claim 14 be depended on claim 13 ?

Claim 18 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. In claim 18, line 2, "ammonia" should be changed to -- nitrogen --.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1-4, 6, 8-10, 12 are rejected under 35 U.S.C. 102(e) as being anticipated by Rodder et al..

See Rodder et al., figs. 1-2D and related text on col. 2-4 which discloses the claimed method for forming a gate electrode including providing a substrate 102; forming a first barrier layer 106 of silicon oxynitride on the substrate 102 by rapid thermal process (fig. 2B, col. 3, lines 25-54); forming a dielectric layer 108 of Ta₂O₅ which has a dielectric constant of about 10 on the first barrier layer 106 (fig. 2C, col. 3, line 55 to col. 4, line 41); forming a second barrier layer of nitride layer 107 by the same

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thermal process on the dielectric layer 108 (col. 4, lines 42-46), performing a post thermal annealing to the dielectric layer (col. 4, lines 46-51); forming a metal gate layer 110 on the dielectric layer 8 (col. 3, lines 19-22); and removing a portion of the metal gate layer 12, the second barrier layer 107 (fig. 2D, col. 4, lines 52-62); etching the structure to form a gate electrode on the substrate 102 (see fig. 1, col. 4, lines 63-65).

Claims 1-4, 6-10, 15 are rejected under 35 U.S.C. 102(e) as being anticipated by Harada.

See Harada, figs. 1-14 and related text on col. 7-21, particularly figs. 7A-8C and related text in the Second Embodiment on col. 13-15 which discloses the claimed method for forming a gate electrode including the steps of forming a first barrier layer 21 of silicon nitride on a substrate 20 (col. 13, lines 37-47); forming a hafnium dioxide layer 22 on the first barrier layer 21 (fig. 7B and text on col. 13, lines 48-60); performing a post deposition annealing process at about 700⁰C on the hafnium dioxide layer 22 (col. 14, lines 22-64); forming a second barrier layer 23 on the dielectric layer 22 (paragraph bridging col. 14 to col. 15); forming a metal gate 24 of Ta or TaN on the second barrier layer 23 (paragraph bridging col. 19-20); etching the metal gate layer 24, second barrier layer 23, dielectric layer 22, and first barrier layer 21 using a mask pattern (well-known as photoresist which is not shown, col. 15, second paragraph).

With respect to claims 2-4, col. 13, lines 41-47 discloses the use of ammonia gas for nitriding the silicon substrate by thermal process at a temperature of about 700⁰C to form the first barrier layer.

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Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 5, 11, 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Harada. In view of Batra et al..

Harada figs. 1-14 and related text on col. 7-21, particularly figs. 7A-8C and related text in the Second Embodiment on col. 13-15 discloses substantially the claimed process for forming a gate electrode as explained above, except silent about the time for thermal process, and the second barrier layer is of silicon dioxide or silicon nitride or silicon oxynitride.

Batra et al., in a related art, as disclosed in figs. 1-3 and text on col. 3-4, the formation of second barrier layer of silicon nitride layer 38 on high dielectric constant layer 24 (fig. 3, col. 4, lines 35-45).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used silicon nitride as suggested by Batra et al. for forming second barrier film 23 in Harada process since it would preventing inter-diffusion between the upper electrode and underlying dielectric film.

With respect to the time for thermal process of claims 5, and 11 which are considered to involve routine optimization which has been held to be within the level of ordinary skill in the art. (as noted In re Aller 105 USPQ233 (CCPA 1955)).

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It would have been obvious to one having ordinary skill in the art at the time the invention was made to have selected a suitable time for obtaining a desired layer thickness or an optimum the result.

Allowable Subject Matter

Claims 13-14, 18 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Claims 16-17, 19-39 allowed.

The following is a statement of reasons for the indication of allowable subject matter: None of the reference of record teaches or suggests the claimed method for forming a gate electrode including a second nitrogen-containing rapid thermal treatment on the gate electrode.


The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Wu discloses a MOSFET with high permittivity gate dielectric.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan H. Nguyen whose telephone number is 571-272-1694. The examiner can normally be reached on 9AM-5:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Tuan H. Nguyen
Primary Examiner
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